constant-value EFL. However, any known or commonly used system that can provide the same control can be used, such as mechanical or hydraulic, which is capable or providing a functionally changing tensile force to the buffer tubes, as they are being wound.

Further, in this embodiment it is preferred that the reel core be covered with a stiffness-compliant pad or sleeve, such as a thin packaging foam pad, as previously discussed, to provide stress relief in the initial layers of the buffer tubes located near the reel core surface (as the windings of the tube closer to the reel core surface have a high increase in EFL). In the preferred embodiment, the thickness, porosity and Young's modulus of the pad is selected to provide the desired stress absorption in the inner layers and provide a substantially uniform EFL distribution in the tube. As with the decay function used, the pad used will be governed by the particular characteristics and design parameters of the manufacturing process.

In a second embodiment of the present invention, the angular velocity of the rotating take-up reel is varied in accordance with a monotonical function (similar to that in the first embodiment with regard to the draw tension) to provide a substantially uniform EFL distribution along the length of the tube. As with the first embodiment, the exact function used to decay the angular velocity would be governed by the individual characteristics of the manufacturing system to be used, but is to be optimized by taking into account all of the factors previously discussed, including, line tension, reel core diameter, material properties, etc. Although it is preferred that a monotonical function be used, it is contemplated that other functions may also be used to vary the reel angular velocity during manufacture, without expanding the scope or spirit of the present invention. Further, although one of the main purposes of the present invention is to create uniform EFL distribution throughout the length

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of a buffer tube, it is contemplated that the present invention can be used to create a controlled non-uniform EFL distribution throughout the length of the cable, where such a non-uniform distribution is desired.

It should be noted that unlike in the first embodiment, to achieve a substantially uniform EFL using the second embodiment of the present invention the function used should increase the angular speed over time through ramping (unlike the first embodiment which decreased the tension over time).

In the preferred embodiment, the angular speed variation can be provided by any known or commonly used system that can provide adequate control of the required speed variations to ensure the function chosen to control the speed is followed as accurately as possible. Existing cable manufacturing devices can be modified to change the speed of the buffer tube and reeling system to adjust the angular velocity of the take-up reel.

Further, in this embodiment it is preferred that the reel core be covered with a stiffness-compliant pad or sleeve, such as a thin packaging foam pad, as previously discussed, to provide stress relief in the initial layers of the buffer tubes located near the reel core surface (although as with the first embodiment the use of the pad is not necessary). As with the function used, the pad used will be governed by the particular characteristics and design parameters of the manufacturing process.

It should be noted that it is contemplated that a combination of the above two embodiments (use of monotonically decreased tension with variations of the reel angular speed) can be used to achieve a substantially uniform EFL distribution.

In a third embodiment of the present invention, soft-cushion pads are inserted periodically with the tubes during the reeling process. This is depicted in Figure 40 where a

pad 41 is periodically inserted in the winding of the tube 42. It is preferred that the pad 41 be the width of the spool 44 and a length equal to the spool circumference at the point of insertion. It is also preferred that the pad be of a material, such as foam sheets, which would accommodate shrinkage in the tube as it cools on the reel 44. It should be noted that as an alternative to using periodically inserted pads 41, it is contemplated that a continuous pad be fed with the buffer tube 42 onto the reel 44 so that a cushioning layer is provided continuously throughout the reeled buffer tube 42. It is further contemplated that a core pad 45, as previously described above, can also be used in this embodiment.

The use of the periodic insertion of pads 41 according to the present embodiment provides space to accommodate shrinkage in the layers of tube 42, so the wraps of the tube 42 are allowed to move in the radial direction and slide toward the center of the spool under the residual loads. The pads 42 act as energy absorbing elements and deform during the cooling of the tube 42 when additional stresses from the tube contraction (during cooling) are experienced. Further, the pads 42 act as spacers to reduce cumulative changes in stresses in very long buffer tube manufacturing. Instead of a long single tube (which was shown previously as having adverse effects on EFL distributions) the pads effectively create a set of smaller reeled windings separated by the cushions or pads 41.

The pads 41 to be used are to have a thickness, porosity and Young's modulus optimized for the particular manufacturing system and specifications and should be optimized to produce a substantially uniform EFL distribution throughout the length of the tube 42. It should be noted that although it is preferred that the pads 41 be of a softer material (having a Young's modulus less than that the of the tube 42) to allow distortion under the loads on the reel, it is also contemplated that a series of stiff panels or planks 43 can be periodically